

WHAT IS CLAIMED IS

1. An organometallic polymeric photonic bandgap material that can be defined by blending block copolymer and at least two homopolymers, thereby obtaining an organometallic polymeric photonic bandgap hybrid material with periodic structure by self-assembly, wherein said homopolymers comprise at least one organometallic homopolymer.
2. The organometallic polymeric photonic bandgap material of claim 1, wherein the structure of said block copolymer is represented by A-b-B, wherein A and B are polymeric compounds.
3. The organometallic polymeric photonic bandgap material of claim 2, wherein said polymeric compounds are polystyrene (PS), polyisoprene (PI), or other as like.
4. The organometallic polymeric photonic bandgap material of claim 1, wherein said periodic structure is arranged according to $(AB)_n$, wherein A and B are defined as above, and n represents natural number.
5. The organometallic polymeric photonic bandgap material of claim 1, wherein the structure of said organometallic homopolymer A' is represented by A-C-D-E, wherein:
 - A is defined as above;
 - C is C_{1~20}alkylene (X), C_{1~20} alkenylene (Y), C_{1~20} alkynylene (Z), or C_{6~20} arylene (W), wherein hydrogen on the W ring atom, if required, can be singly, dually, triply, or quadruply substituted by the substituent groups selected from X, Y, W and Z;
 - D is O, N, Si, P, S or CH₂;
 - E is selected from the group consisting of titanium (Ti), zirconium (Zr), hafnium (Hf), vanadium (V), niobium (Nb), tantalum (Ta), chromium (Cr), molybdenum (Mo), tungsten (W), manganese (Mn), technetium (Tc), rhenium (Re), iron (Fe), ruthenium (Ru), osmium (Os), cobalt (Co), rhodium (Rh), iridium (Ir), nickel (Ni), palladium (Pd), platinum (Pt), copper (Cu), silver (Ag), gold (Au), scandium (Sc), and compounds thereof.
6. The organometallic polymeric photonic bandgap material of claim 5, wherein said E is selected from the group consisting of titanium (Ti), chromium (Cr), molybdenum (Mo), tungsten (W), manganese (Mn), technetium (Tc), rhenium (Re), iron (Fe), ruthenium (Ru), osmium (Os), cobalt (Co), rhodium (Rh), iridium (Ir), nickel (Ni), palladium (Pd), platinum (Pt), and compounds thereof.

7. The organometallic polymeric photonic bandgap material of claim 6, wherein said E is selected from the group consisting of titanium (Ti), chromium (Cr), molybdenum (Mo), tungsten (W), iron (Fe), ruthenium (Ru), osmium (Os), nickel (Ni), palladium (Pd), platinum (Pt), and compounds thereof.
8. The organometallic polymeric photonic bandgap material of claim 1, wherein the structure of said organometallic homopolymer is represented by A-C-E, wherein A, C, and E are defined as above.
9. The organometallic polymeric photonic bandgap material of claim 1, wherein the structure of said organometallic homopolymer is represented by A-D-E, wherein A, D, and E are defined as above.
10. The organometallic polymeric photonic bandgap material of claim 1, wherein the structure of said organometallic homopolymer is represented by A-E, wherein A and E are defined as above.
11. An organometallic polymeric photonic bandgap material that can be defined by blending block copolymer (A-b-B) and homopolymers A' and B, thereby obtaining an organometallic polymeric photonic bandgap hybrid material with periodic structure by self-assembly, wherein said homopolymer A' is an organometallic homopolymer, the structure of A, B, and A' are defined as above.
12. The organometallic polymeric photonic bandgap material of claim 11, which can be utilized to form an one-dimensional structural system, wherein the weigh ratio of A : B is 0.5 :0.5 for said structural system.
13. The organometallic polymeric photonic bandgap material of claim 11, which can be utilized to form a two-dimensional structural system, wherein the weigh ratio of A : B is 0.3 :0.7 for the structural system.
14. The organometallic polymeric photonic bandgap material of claim 11, which can be utilized to form a three-dimensional structural system, wherein the weigh ratio of A : B is 0.35 :0.65 for said structural system.
15. The organometallic polymeric photonic bandgap material of claim 11, wherein the dimension of each domain is 15 to 5000 nm , the reflected wavelength is 50 to 5000 nm , and the

reflectivity is higher than 50%.

16. The organometallic polymeric photonic bandgap material of claim 11, wherein said periodic structure is arranged according to (AB)_n, wherein A and B are defined as above, and n represents natural number.
17. A manufacturing process of organometallic polymeric photonic bandgap material comprises the following steps:
 - Synthesizing organometallic homopolymer A';
 - Dissolving and blend homopolymer A', block copolymer (A-b-B), and homopolymer B in an appropriate solvent;
 - Keeping in room temperature for volatilizing the solvent; and
 - Placing in oven for assuring all remained solvent has been removed.
18. The manufacturing process of organometallic polymeric photonic bandgap material of claim 17, wherein said structure of A, B and A' are defined as above.
19. The manufacturing process of organometallic polymeric photonic bandgap material of claim 17, wherein said solvent is cumene, toluene, benzene, or other as like.
20. The organometallic polymeric photonic bandgap material of claim 1 or 11, which is composed of PS-b-PI/Tp(PPh₃)[(PS)nPPh₂P]Ru-C=C(Ph)CHCN/PI.
21. The organometallic polymeric photonic bandgap material of claim 20, wherein the weight ratio of said PS-b-PI/Tp(PPh₃)[(PS)nPPh₂P]Ru-C=C(Ph)CHCN/PI is 98/1/1.
22. The organometallic polymeric photonic bandgap material of claim 1 or 11, which is composed of PS-b-PI/(III)Ti-PSn/PI.
23. The organometallic polymeric photonic bandgap material of claim 22, wherein the weight ratio of said PS-b-PI/(III)Ti-PSn/PI is 76/12/12.
24. The organometallic polymeric photonic bandgap material of claim 1 or 11, which is composed of PS-b-PI/Tp(PPh₃)₂NiBr-PS/PI.
25. The organometallic polymeric photonic bandgap material of claim 24, wherein the weight ratio of said PS-b-PI/Tp(PPh₃)₂NiBr-PS/PI is 76/12/12.
26. The organometallic polymeric photonic bandgap material of claim 1 or 11, which is composed of PS-b-PI/(CO)₅W[(PS)nPPh₂P] /PI.